

Project Code and Title

B.01.18 - Upgrade Fuel System Integrity - Alternatively Fueled Vehicles

Project Objective

To insure a minimum level of integrity for the fuel containers and systems of vehicles powered by compressed natural gas (CNG), liquefied petroleum gas (LPG or propane), liquefied natural gas (LNG), hydrogen, and other alternative fuels, excluding electric.

Background

Although alternatively fueled vehicles have been in use in this country for many years, interest in them has just recently shown rapid increase. This increased interest is expected to result in a 150% increase in the number of such vehicles on the nations roads by the year 2000. NHTSA has decided to be proactive in this area by taking a national leadership role to assure that the fuel systems and components of these vehicles perform safely on the road and in crashes.

In January of 1993, NHTSA issued an NPRM to establish performance requirements for OEM vehicles fueled by compressed natural gas (CNG). The NPRM was divided into two segments: 1) vehicles requirements which focus on the integrity of the fuel system as a whole, and 2) equipment requirements which focus on the fuel containers alone.

In the fall of 1993, research was conducted to support the first segment of the NPRM. The proposed method for evaluating fuel leakage through the measurement of fuel system pressure loss was examined both in laboratory bench testing and in a crash test. Overall, it was found that this method is workable and practical, although some consideration must be made for extreme ambient temperature conditions. FMVSS No. 303 was issued in April 1994, which regulates CNG vehicle fuel system integrity, effective September 1, 1995.

In the spring and summer of 1994, research was conducted to evaluate the National Fire Protection Association (NFPA) Standard Number 52 for its suitability in ensuring adequate safety in vehicles converted to CNG after first sale. Also, a task was undertaken to evaluate the suitability of Compressed Gas Association, Inc. (CGA) suggested guidelines for CNG fuel cylinder inspections. FMVSS No. 304 was issued in September 1994, to regulate the initial strength, durability, and pressure relief performance of CNG fuel cylinders, effective March 27, 1995.

In addition to these regulations, an SNPRM was issued in December 1994 to address additional CNG cylinder safety performance, including corrosion, brittle fracture, and external damage, as well as container and vehicle labeling requirements. These regulations are based on NVG2 voluntary test and compliance standards which are currently undergoing revisions

and updating. Final evaluation of these standards is currently on hold until the final revisions by NVG2 are completed and published.

In the Fall of 1995, research was initiated to develop a method for evaluating fuel leakage from an LPG fuel system. Both laboratory bench testing and crash testing of LPG converted vehicles will be used in this analysis. This effort will include an evaluation of the National Fire Protection Association (NFPA) Standard Number 58 for its suitability in ensuring adequate safety in vehicles converted to LPG after first sale.

Also, in May 1994, NHTSA issued a request for comment on whether to regulate the fuel system integrity of CNG vehicles over 4536 kg GVWR. The agency has decided not to pursue regulatory activities for CNG vehicles over 4536 Kg GVWR or for LNG fueled vehicles at this time.

Problem Definition

It is estimated that over 300,000 alternatively fueled vehicles are currently on the roadways in the United States. It is projected that this number will climb to over 750,000 by the year 2000. Although some states have established regulations for these vehicles, the fuel system integrity of some alternatively fueled vehicles (e.g., LPG, LNG, and hydrogen) remains essentially unregulated at the national level. At this time, these vehicles are not available in large enough numbers to produce meaningful statistical data on accidents and injuries.

Research Approach

The research supports the Office of Safety Performance Standards initiatives for fuel system integrity of alternatively fueled vehicles powered by CNG, LPG, LNG, hydrogen, and other alternative fuels excluding electric vehicles. Therefore, the specific tasks will be developed as rulemaking needs arise.

Several tasks were identified concerning vehicles fueled by CNG. The first was to examine the method proposed in FMVSS No. 303 evaluating fuel leakage in OEM vehicles. Task 2 evaluates the National Fire Protection Association (NFPA) Procedure # 52's suitability in ensuring adequate safety in vehicles converted to CNG after first sale. A third task was to evaluate the suitability of Compressed Gas Association, Inc. (CGA) suggested guidelines for CNG fuel cylinder inspections for labeling requirements. Task 4 evaluates NGV2 procedures addressing CNG cylinder safety performance, as proposed in the SNPRM of December 1994.

Tasks 5 and 6 are in conjunction with potential rulemaking for the safe performance of vehicles powered by liquefied petroleum gas (LPG). The development of methods to evaluate fuel leakage in OEM vehicles powered by LPG began in FY95. Investigation as to the suitability of NFPA procedure number 58 for ensuring adequate fuel system integrity for converted (after first sale) LPG vehicles began in FY 1996.

Potential Impact/Application

Upgrade of FMVSS No. 301, 303, and/or 304

Key Milestones

- ▶ Tasks 5 and 6 9/96 - complete draft report

RESOURCE REQUIREMENTS	FY95	FY96	FY97	FY98	FY99
Contract Money (\$K)	150	0	50		

Project Manager(s)

Donald T. Willke

Completion Date

Ongoing

Publications

External reports:

1. K.W. Looker; "Final Report of a 1992 Dodge Ram B250 Van Rear Impact CNG Fuel Tank Integrity;" report number DOT-HS-808-300; October 1993.
2. C.A. Markusic; "Final Report of a 1991 Plymouth Acclaim Rear Impact CNG Fuel Tank Integrity;" report number DOT-HS-808-252; August 1994.
3. C.A. Markusic; "Final Report of a 1991 Ford F150 Pickup Frontal Impact CNG Fuel Tank Integrity;" report number DOT-HS-808-253; August 1994.

Internal reports:

1. "Compressed Natural Gas Fuel System Integrity;" event report for project VRTC-83-0307; July 1994.
2. Memorandum report on Evaluation of NFPA 52, July 1995.

Keywords: Alternative Fuels, CNG, LPG, National Fire Protection Association (NFPA) 52, National Fire Protection Association (NFPA) 58

Project Tasks

<u>Task</u>	<u>Title and Description</u>
Task 1	OEM/CNG Fuel Leakage Evaluation
Task 2	NFPA 52 Evaluation
Task 3	CGA Inspection Evaluation
Task 4	Evaluation of NGV2 Standards
Task 5	OEM/LPG Fuel Leakage Evaluation
Task 6	NFPA 58 Evaluation

Task	Start Date	Projected Completion Date	Status/Responsibility
1	8/93	7/94	complete
2	5/94	7/95	complete
3	5/94	11/94	complete
4	7/95		on hold for higher priority programs
5	6/95	9/96	report being drafted
6	9/95	9/96	report being drafted

Supporting Contracts

Task	Contract Number	COTR (phone)	Contracting Officer (phone)	Total Contract Cost (\$K)
1	VRTC	Donald T. Willke (513)666-4511	Robin Esser (513)666-4511	\$60K
2	VRTC	Donald T. Willke (513)666-4511	Robin Esser (513)666-4511	\$60K
3	VRTC	Donald T. Willke (513)666-4511	Robin Esser (513)666-4511	\$25K
4	VRTC	Donald T. Willke (513)666-4511	Robin Esser (513)666-4511	\$100K
5	VRTC	Donald T. Willke (513)666-4511	Robin Esser (513)666-4511	\$60K
6	VRTC	Donald T. Willke (513)666-4511	Robin Esser (513)666-4511	\$90K